# Dropping In a Microgravity Environment

*School year 2004/2005*

Student teams in the fifty United States, the District of Columbia, and Puerto Rico are eligible.

CHECK THE DIME WEB PAGE FOR IMPORTANT UPDATES

## Program Announcement

DIME is a NASA educational program for teams of high-school-aged students to design and build a science experiment to be tested in a NASA microgravity drop tower.

DIME 2004 teams and NASA staff in front of the NASA Glenn 2.2 Second Drop Tower

National Aeronautics and Space Administration
**Glenn Research Center**

# WHAT IS **DIME?**

The NASA Dropping In a Microgravity Environment (DIME) is a wonderful opportunity for students to experience the process of cooperative scientific research from start to finish. Student teams develop a hypothesis that can be tested through experimentation and then submit a scientific research proposal. A panel of NASA scientists and engineers evaluate the proposals and select up to four of the best proposals.

If selected, the student team will design and construct their science experiment within the DIME guidelines for operation in a NASA microgravity drop tower. Four student team members and one adult advisor from each selected team win an expense-paid trip to NASA Glenn Research Center in Cleveland, Ohio during Drop Days. The team members will assist in the operation of their experiment in the drop tower and participate in workshops, tours and other educational activities. After Drop Days, a final report is prepared by each selected team.

The fifth annual DIME competition will occur during the 2004/2005 school year with participation open to teams of students in grades 9 to 12 located throughout the fifty United States, the District of Columbia, and Puerto Rico.

Further information is available on the WWW at

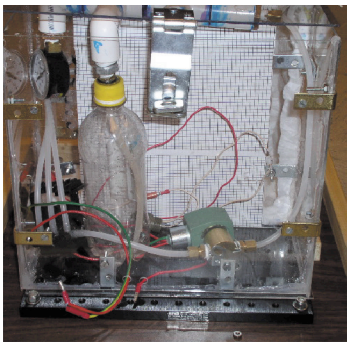
`http://microgravity.grc.nasa.gov/DIME.html`

## Questions and Comments

This brochure contains all necessary information for submitting entries to the DIME competition. If you still have questions after reviewing these resources, please contact us at this address.


NCMR / DIME
NASA GRC, MS 110–3
21000 Brookpark Road
Cleveland, OH 44135

E-mail: `DIME@grc.nasa.gov`
Fax: 216-433-3793

Complex plumbing in a DIME 2003 experiment for water streams in microgravity

## Learning Goals Aligned With National Education Standards

The DIME program supports specific national standards in science and technology. Participation in DIME will contribute to student mastery of these standards:

**National Science Teachers Association Standards**

- Science as inquiry
  - + Abilities necessary to do scientific inquiry
- Science and technology
  - + Abilities of technological design

**International Technology Education Association Standards**

- Design
  - + Students will develop an understanding of the attributes of design


## Key Dates (subject to change)

| | |
|---|---|
| November 1, 2004 | Postmark deadline for mailing proposal to NASA GRC |
| by December 17, 2004 | Selected teams announced |
| April 1, 2005 | Delivery of experiment package at NASA |
| April 19-21, 2005 | Drop Days at NASA |
| June 3, 2005 | Deadline for mailing final report to NASA |

# **DIME** OVERVIEW

**Microgravity is a condition in which the effects of gravity are greatly reduced compared to those experienced in normal conditions on Earth. The microgravity condition is easily created by a free fall within a gravitational field. Refer to the DIME Educators Resource Guide for more information on microgravity.**

## Getting Started

This DIME Announcement includes the core details needed to enter the competition. The DIME CD and web site contain additional information related to microgravity and classroom activities.

The most important factor in developing a winning proposal is to select a research topic that shows a significant effect of gravity which will be reduced in a microgravity environment. It must also be observable and measurable in 2.2 seconds of microgravity.

Information for guidance on selecting an experiment topic is contained in the DIME Educators Resource Guide. Requirements for design of the experiment are contained in the DIME Experiment Design Requirements document. Both are available from the DIME CD and/or web site.

## DIME Fundamentals

When done methodically, developing a microgravity experiment need not be daunting. The following is the sequence of steps in a successful DIME entry:

1. Develop a hypothesis and select an experiment.
2. Conduct normal gravity research related to your experiment.
3. Develop a proposal as explained on page 3.
4. Submit proposal as detailed on page 4.
5. Upon selection by NASA, design the proposed experiment, following guidelines in the DIME Experiment Design Requirements document.
6. The selected teams will be assigned a NASA mentor who will provide guidance and support as the team continues through the process of designing and fabricating the experiment apparatus.
7. Submit Preliminary Design to NASA for review.
8. Construct the experiment and test in 1-g.
9. Submit final design documents.
10. Ship experiment to NASA.
11. Participate in Drop Days at NASA.
12. Submit final written report.

## DIME Schedule

When preparing your proposal, observe the key dates listed on page 1, in particular, the proposal submission postmark date. Proposal receipt confirmation will be sent to each team.

Please make certain that your team representatives will be available to participate in DIME Drop Days in April.

## Evaluation

All entries will be evaluated by a team of scientists, engineers, and educators according to the selection criteria published in this announcement. Up to four proposals will be selected for further development of their experiment. Both selected and non-selected teams will be notified of the results.

## DIME Drop Days

### NASA Glenn trip

From each of the selected teams, four student representatives and one adult advisor win travel, room, and board for a three-day visit to NASA Glenn in Cleveland, Ohio, for the DIME Drop Days in April. All individuals coming to NASA will be required to provide verification of their U.S. citizenship.

### Team members at home locale during Drop Days

The remainder of the team at their home locale will be able to connect to the Internet and monitor some of the experiment drop activities of the teams during Drop Days at NASA Glenn Research Center.

## Final Report

Following DIME Drop Days, each selected team will be required to prepare a final report and submit it to NASA.

Team ready to load their experiment in the drop tower during DIME Drop Days 2004

# DIME EXPERIMENT DESIGN OVERVIEW

This section will assist a DIME team with understanding the scope of their proposed experiment. This section contains a summary of the capabilities of the NASA drop tower and a summary of constraints on the team's experiment. The selected teams need to consult the DIME Experiment Design Requirements document for the complete requirements prior to building their experiment.

In summary, a team's experiment will be placed in the NASA Education Rig for drop operations in the drop tower. The Education Rig provides certain equipment to support all experiments, such as a video camera, lights, electrical power, and a data logger. On the other hand, the Education Rig also imposes some constraints on the DIME team's experiment to ensure the experiment will fit and function properly.

Creating the experiment apparatus will provide the student teams the opportunity to utilize or develop knowledge of electrical and mechanical engineering and design as well as fabrication skills. These skills are needed to design and build an experiment within the constraints of facility operations, safety, and capabilities of the Education Rig.

NASA provides to each selected team an adaptor plate on which the team's experiment is built. This adaptor plate has a matrix of threaded holes which are used to mount components of the team's experiment. This adaptor plate forms the base of the team's experiment and is used in turn to fasten the experiment into the NASA drop tower Education Rig.

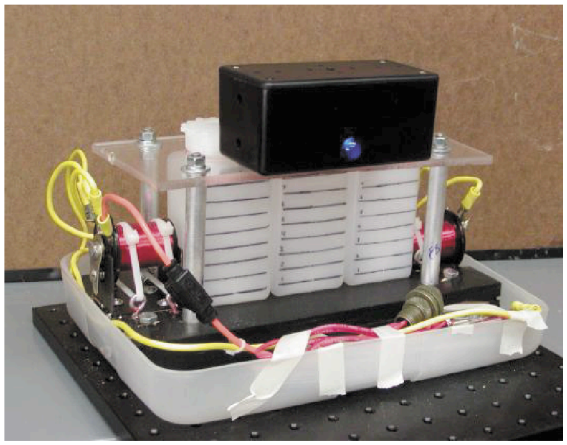
The Education Rig provides the following equipment and capabilities.

1. A video camera (30 frames per second) and zoom lens.
2. An electronic data logger with analog and digital inputs.
3. Electrical controls to turn experiment devices on and off at desired times to control an experiment.
4. Lighting at the front or back of the experiment.
5. Electrical power at 28 volts and 12 volts for an experiment.

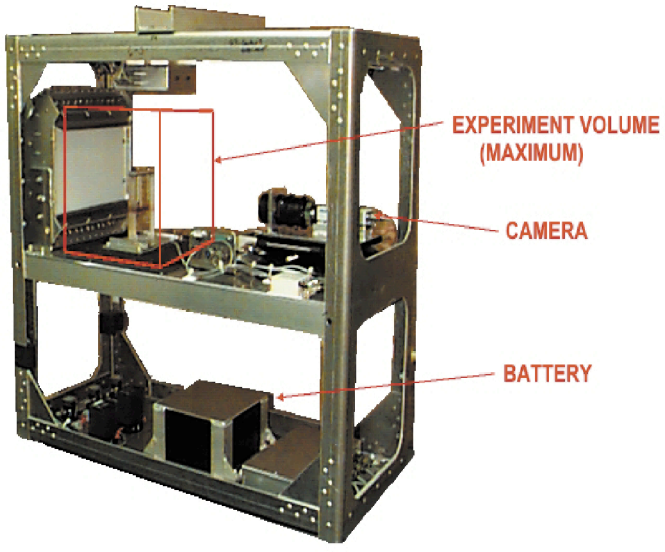
Constraints on a DIME team's experiment include the following.

1. The experiment shall be constructed within a cube 30.54 cm (12 in.) on a side.
2. The experiment mass shall not be more than 11.3 kg (25 lbs) (including the adaptor plate mass of 3 kg).
3. The experiment shall meet the safety rules included on page 5 of this announcement.

Remember that the selected teams must follow the requirements contained in the DIME Experiment Design Requirements document when designing and constructing their experiment.



Typical student-team-built experiment containing three fluid containers, electromagnets, electrical controls, and a "free-fall" indicator light. The NASA-provided adaptor plate is below the white leak-containment pan.




Education Rig from the NASA Glenn 2.2 Second Drop Tower showing some major components and the location of the DIME student experiments.

# DIME PROPOSAL PREPARATION

**Proposal Components**

In order to be selected to build and drop an experiment, teams must demonstrate that the student members of the team understand the scientific principles involved in their proposal. They need to be prepared to design and build the experimental apparatus in time for Drop Days. The team will submit a proposal containing the five sections listed below. Sections I-III are limited to a total of 1500 words.

**I. Scientific Objectives**

A. Describe briefly and clearly the research question you hope to answer.

B. Describe how you expect your proposed experiment to be changed by microgravity.

C. Include a hypothesis that can be tested in 2.2 seconds of microgravity.

D. Describe the procedures that will be used to observe, measure and interpret the results.

E. Describe the purpose and potential benefits from this experiment and address practical applications of the work.

**II. Technical Plan**

A. Give a clear, detailed description of the experimental apparatus to be used and any hardware to be built. At least one figure or diagram of the experiment must be included in section V of your proposal.

B. Describe the expected sequence of events during the operation of the experiment. Explain how it will answer your research question.

C. Explain the design features that will allow the experiment to survive impact and be usable for another drop.

D. Explain how your experiment will provide useful data which can be collected in 2.2 seconds.

E. Describe ground testing prior to reduced-gravity testing.

F. Be sure the design meets the safety and design requirements as specified in the DIME Experiment Design Requirements document (available from the DIME CD and/or web site).

G. Scrupulous attention to the DIME Competition Rules suggests that teams will be able to meet all the requirements for a safe and successful operation.

**III. Team Organization**

Because experiment design, development, and operation is a team effort at NASA, this competition is designed to involve teamwork. In particular, teams should include students able to perform the following kinds of tasks:

- Planning and coordinating work
- Designing experiments
- Building experimental apparatus
- Conducting experiments
- Communicating the plans and results of the project

In your proposal, include the following material:

A. Describe your plan for accomplishing the work necessary to carry out the proposed experiment, including the researching of the topic and writing of the final report.

B. Describe the variety of skills individual members bring to the team.

C. Explain how your team will share an appropriate distribution of workload and responsibilities.

**IV. Resource Credits**

List all referenced books, periodicals, and web sites following a standard style, such as American Psychological Association (APA). Note that this section is not included in the word count. A variety of resources should be used.

**V. Figures**

This section will contain from one to five single-sided pages of figures that illustrate the concept of the proposed experiment. The figures must be numbered in sequence and referenced from the text. The caption text must be in the font specified for the proposal text.

## Evaluation Criteria

The proposal will be evaluated using a rubric (see page 8) with total points assigned as follows:

- Scientific Objectives 41
- Technical Plan 30
- Team Organization 9
- Creativity, Attention to Detail, Grammar, and Originality 12
- Resources 8

**Proposal Format Requirements**

1. The proposal must be typed or computer-printed, double-spaced, using 12-point Times font, not bold or italic, and left justified. A 1-inch margin should be used for all sides of the pages. Portrait format shall be used for the pages. Leave $1\frac{1}{2}$ inches blank at the top of the first page for a DIME evaluation label.
2. The proposal must be stapled in the upper left corner.
3. The proposal may not have a title page, folder or covers.
4. The proposal must have a title which must not exceed 60 characters in length including spaces. The title should be placed at the top of the first page.
5. Student names, advisor name(s), or any information that would identify the team, associated school or organization, or their location must not appear anywhere in the proposal. This will help ensure unbiased evaluation by the evaluators.

# **DIME** COMPETITION RULES

1. Teams located in the fifty United States, the District of Columbia, and Puerto Rico are eligible to participate in DIME.
2. Team members must be students in grades 9 to 12.
3. The team member roster may contain no more than one student who has attended DIME Drop Days at NASA Glenn in a previous year.
4. None of the DIME team members, including the adult advisor, may have worked at any NASA facility within the last three (3) years, or may have immediate family members who have worked at any NASA facility within the last three (3) years, with the exception of an internship lasting no more than three months.
5. An organization may submit a maximum of four proposals in any one year. However, no more than one proposal will be selected from a single organization.
6. A DIME entry comprises an Entry Form (parts A and B), an Entry Checklist Form, and six identical and complete copies of the proposal, all in a single package.
7. Late entries, entries sent by facsimile or electronic mail, and entries not complying with competition rules will be disqualified.
8. Entry materials will not be returned; retain a copy for your records.
9. The student team must conceive and develop the experiment and proposal.
10. Proposals must follow preparation guidelines and format requirements as listed on page 4 of this announcement.


11. The DIME entry must be postmarked by the date given on page 1 and addressed to:

    NCMR / DIME Proposal
    NASA GRC, MS 110–3
    21000 Brookpark Road
    Cleveland, OH 44135

12. Proposed experiments must conform to the requirements contained in the DIME Experiment Design Requirements document.
13. Safety rules for experiments:
    a. Dangerous or hazardous chemicals (including radioactive materials) or chemical reaction products must not be used in the experiment.
    b. The following fuels shall not be used in DIME combustion experiments: flammable gases, flammable liquids, explosives, fireworks, model rocket engines, metals, and powders.
    c. Liquids and all other materials and components (with the exception of harmless gases), shall be contained within the experimental apparatus.
    d. Biological samples, for the most part, may not be used in the experiment, except for common household products (e.g. cotton, wood, etc.). Live animals, even insects, are not acceptable.
    e. Experiment pressures may not exceed 15 psig (pounds per square inch as measured on a gauge, relative to ambient pressure).
    f. Lasers must not be used in an experiment.
    g. The maximum voltage allowed in an experiment is 28 volts.
    h. A waiver, granting an exception to a safety rule above, may be requested by sending such a request to `dime@grc.nasa.gov` with an explanation of how any associated hazards will be controlled. Such waiver requests must be submitted no later than October 15. Note that waivers will not be granted for exceptions to the bans on lasers or radioactive materials.
14. Up to four student team representatives and one adult advisor from each selected team may attend DIME Drop Days at NASA Glenn Research Center in Cleveland, Ohio.
15. No more than one non-U.S. citizen per team may attend DIME Drop Days at NASA. After DIME 2005, all visitors to NASA GRC for DIME Drop Days must be U.S. citizens.
16. All DIME committee decisions are final.

# DIME Entry Form - Part A

**Complete forms in blue or black ink.**

| **Proposal title** |
|---|
| |

**Proposal summary (maximum 50 words)**

| **Grade Level(s) of team members (circle all that apply)** |
|---|
| 9 10 11 12 |

_____

_____

_____

## Student Team Member Information

Total number of student team members submitting this proposal: ____

*Teams may include more than four student team members to ensure that necessary skills are represented on the team, although, only up to four student representatives and one adult advisor will travel to NASA Glenn Research Center in Cleveland, Ohio for participation in DIME Drop Days.*

| TEAM MEMBER NAMES (printed) | SIGNATURE |
|---|---|
| 1. _____ | _____ |
| 2. _____ | _____ |
| 3. _____ | _____ |
| 4. _____ | _____ |
| 5. _____ | _____ |
| 6. _____ | _____ |
| 7. _____ | _____ |
| 8. _____ | _____ |

For additional team members, attach a list of students' names and signatures and indicate here the number of additional pages of students' names and signatures. _____

# DIME Entry Form - Part B

**Complete forms in blue or black ink.**

| **Proposal title** |
| --- |
| |

## Advisor Information

Lead advisor name: _____

Additional advisor name (optional): _____

Additional advisor name (optional): _____

Sponsoring organization: _____

Mailing address: _____

_____

_____

City: _____ State: _____ ZIP _____ - _____

Telephone number: _____ - _____ - _____ Fax number: _____ - _____ - _____

Lead advisor's e-mail address: _____

School / organization WWW address: http:// _____

_____

We affirm that this team proposal for the DIME is original and has been conceived and developed by the student members of the team. We further affirm that we have read and understand the rules of the DIME competition. We understand that entries are the property of NASA and may be used for publicity or outreach purposes. Copyrighted materials are properly identified and cited and permission has been obtained for their use.

Lead Advisor's signature: _____

Date: _____

## Supervisor / Principal Agreement

I understand that if this proposal is selected by NASA, it commits four student team members and one adult advisor to a three day field trip in April at NASA Glenn Research Center in Cleveland, Ohio.

Supervisor's signature: _____

Date: _____

# DIME Entry Checklist Form

**Proposal title**

Mark each item as you prepare your package.
This completed Entry Checklist Form must accompany each entry.
Failure to follow instructions will result in disqualification.

## Team Checklist

**Entry Form (pages A & B)**

- O We have completed the Entry Form in only blue or black ink.
- O We have indicated the grade levels for our team members.
- O We have placed the proposal title identically on all entry components.
- O We have provided a proposal summary on Entry Form part A.
- O We have legibly listed the name of each team member.
- O We have signed the Entry Form on the line provided beside our name.

**DIME Proposal**

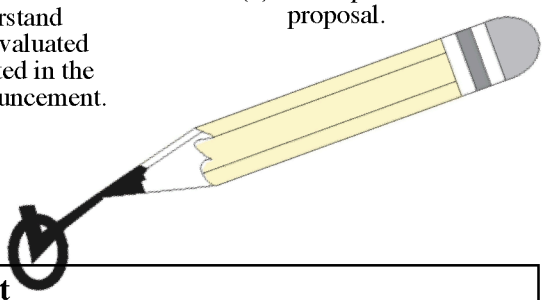
- O The proposal does not have school, city, state, student, teacher, advisor, parent names, sponsoring organization or any identifying information on it anywhere.
- O It does not have a title page, folder, or other covers.
- O We are submitting print material in portrait format on 8 ½ by 11 inch paper in 12 point Times font, double-spaced plain (not bold or italic), left-justified type for the body.
- O One inch margins are used for all pages.
- O We have left 1 ½ inches of paper blank at the top of the first page of our proposal.
- O A title is on the top of the first page and contains 60 characters or less, including spaces.
- O We have kept a copy of our proposal and understand that our proposal will not be returned.
- O We have had someone else proofread our proposal for typing mistakes, misspellings, and incomplete sentences.

**Evaluation**

- O We have read and understand the criteria for the DIME competition and understand our proposal will be evaluated against the criteria listed in the DIME Program Announcement.

**Assembly of Entry**

- O We stapled each of the six copies of our proposal in the upper left corner.
- O We have placed the following entry components in a single envelope:
  - (1) our Entry Form (parts A & B),
  - (2) completed Entry Checklist Form, and
  - (3) six copies of the proposal.



## Advisor Checklist

- O I have signed and dated the Entry Form on part B.
- O Advisor information is accurate and complete.
- O This proposal has been proofread.
- O If mailing entries from multiple teams, my advisor information is listed identically on each Entry Form and each team entry is placed in its own envelope.
- O Copyrighted material has been properly identified and cited and permission has been obtained, where necessary, for its use.

Lead Advisor's signature: _____

Date: _____

# DIME Entry Package Evaluation

Each entry package submitted for the DIME competition will be evaluated by the process explained here.

The DIME entries are received and cataloged by a DIME administrator. Each entry package is first evaluated for adherence to the DIME competition rules. Entry packages which do not conform to the rules are put aside and are not further evaluated.

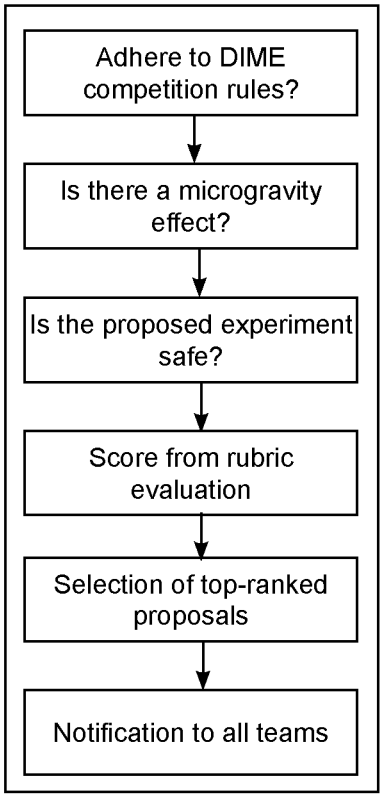
Please note that the DIME rules state that proposals must be prepared in a manner which does not include team identification. This facilitates an evaluation by a panel of NASA scientists and engineers without bias to factors such as a team's location.

The DIME program is intended for microgravity experiments where an effect of gravity has a significant effect. Therefore, all proposal research topics will be pre-screened for microgravity effects by the NASA panel.

Safety is a critical issue in test facilities. The proposals will also be pre-screened for issues which could jeopardize the safety of personnel and/or equipment. Early in a team's proposal preparation stage, a team may wish to contact the DIME sponsors and discuss the safety aspects of a proposed experiment concept.

The rubric detailed on the following eight pages is that which will be used by the NASA team to evaluate and score the proposals. A team should familiarize themselves with this scoring rubric when preparing a proposal. The rubric sections and the possible points by section are summarized in the table below.

If proposal scores are statistically close, selection preference will be given to proposing organizations who have not been selected in previous DIME years and/or who are in geographical areas not represented in previous DIME years.




**DIME Proposal Evaluation Flow**

DIME Proposal Possible Scores by Section

| | |
|---|---|
| I. SCIENCE OBJECTIVES | 41 |
| II. TECHNICAL PLAN | 30 |
| III. TEAM ORGANIZATION | 9 |
| IV. CREATIVITY, ORIGINALITY, ATTENTION TO DETAIL | 12 |
| V. RESOURCE CREDITS | 8 |
| --- | --- |
| Total | 100 |

# I. SCIENCE OBJECTIVES

| | A. RESEARCH QUESTION / HYPOTHESIS | | | |
|---|---|---|---|---|
| **POINTS** | **1. Does the proposal have a clear research question and hypothesis?** | **2. Does the proposal have a hypothesis related to the research question?** | **3. Is microgravity a major factor in this proposed experiment?** | **4. Is the hypothesis testable in 2.2 seconds?** |
| **1** | Neither research question nor hypothesis are presented in the proposal. | The relationship of the hypothesis and the research question cannot be determined. | No clear connection to microgravity is explained. | Unable to detect factors in experiment to determine response time. |
| **2** | An unclear research question or hypothesis is stated. | The hypothesis is unclear; the experiment relates poorly or not at all to the research question. | The need for microgravity effect is unclear or was not explained clearly. | The information is unclear or not stated; the experiment samples may need to be modified. |
| **3** | A research question and hypothesis are present but both are poorly stated, or may contain inaccuracies. | The hypothesis is clear and is somewhat related to the research question. | A microgravity effect is clear and somewhat utilized in the experiment. | Response time short enough for reaction to be complete within 2.2 seconds. |
| **4** | A clear research question and hypothesis are present but they are not testable, variables are not identified, or they contain inaccuracies. | The hypothesis is clearly stated and it appears that the experiment will yield significant data related to the research question. | The microgravity effect is clearly stated and is utilized in the experiment. | N/A |
| **5** | The research question is clear, the hypothesis is testable, variables are identified; variables are identified as dependent, independent, and control is defined. | The hypothesis is clearly stated and the experiment will yield data that address research question and hypothesis in a compelling way. | Microgravity is essential to the hypothesis and the research question and is described in detail. | N/A |

# I. SCIENCE OBJECTIVES (cont'd)

| | B. RESEARCH METHOD | | | |
|---|---|---|---|---|
| **POINTS** | **1. Is the procedure specific on how observations and measurements will be made and interpreted to prove or disprove the hypothesis?** | **2. Are sufficient details given so that others can understand the proposed experiment?** | **3. Will the plan provide enough data points or information to reach a conclusion?** | **4. Are ground-based controls and variables addressed?** |
| **1** | No information given. | No details given. | Multiple samples or measurements are not considered in plan. | No information presented. |
| **2** | Sketchy information presented. | Insufficient information present in proposal. | Plan is unclear about number of samples or number of drops. | Plan for ground-based tests described. |
| **3** | Plan for measurements, observations, and procedures needs major revisions to be useful. | Incomplete or confusing information would make it difficult to replicate the proposed work. | Number of samples and/or multiple drops are addressed in plan but will need modification. | Ground-based tests have been performed. |
| **4** | Measurements, observations, and procedures appear to be sufficient with minor modifications. | Information presented is complete but requires small amount of 'educated judgement'. | Number of samples and/or multiple drops appear appropriate to get sufficient data points. | N/A |
| **5** | Measurements, observations, and procedures appear to be sufficient. | Experiment fully described and understandable. | N/A | N/A |

# I. SCIENCE OBJECTIVES (cont'd)

| | C. POTENTIAL SCIENTIFIC / PRACTICAL BENEFITS | |
|---|---|---|
| **POINTS** | 1. Are there potential scientific benefits from this research? | 2. Are practical applications of the work present and addressed? |
| **1** | No benefits cited in proposal or benefits are questionable. | No practical applications cited in proposal or applications are questionable. |
| **2** | Benefits are cited. | Practical applications are cited. |
| **3** | Benefit cited as a reason for considering the experiment topic. | Practical applications cited as a reason for considering the experiment topic. |

# II. TECHNICAL PLAN

| | A. DESIGN PLAN | | |
|---|---|---|---|
| **POINTS** | **1. Is there a clear and detailed description of the experimental apparatus?** | **2. Are legible and labeled drawing(s) included?** | **3. Does the proposal allow the experiment to survive impact and be usable for additional drops, or take this factor into account?** |
| **1** | No technical plan is presented. | No drawings are included. | Impractical; not correctable. |
| **2** | Plan is vague or confusing. The experiment is not suitable for the drop tower. | Drawings are vague or confusing. | May work, if substantially modified. |
| **3** | A good start, but many key questions are not addressed. Plan is not clearly described; there appear to be serious technical problems. | Good drawings, but not enough detail. | Will work, if moderately modified. |
| **4** | Reasonably clear, but some key questions are not addressed. The experiment seems practical. | Good drawings, but some key details are not addressed. | Will work, only minor issues remain. |
| **5** | Clear and thorough, most key questions are addressed. The technical plan is clear and complete or requires only small changes to adapt the experiment to the drop tower. | Clear and thorough drawings with key questions addressed. | No problems. |

# II. TECHNICAL PLAN (cont'd)

| | A. DESIGN PLAN (cont'd) | | B. DESIGN SAFETY |
|---|---|---|---|
| **POINTS** | **4. Will the design allow data to be collected that addresses the research question?** | **5. Will the design permit collection of appropriate data in 2.2 seconds?** | **Does the design meet the safety, interface and operational requirements specified?** |
| **1** | No data collection plan is presented. | No data collection plan is presented. | Insufficient information is presented. |
| **2** | Plan mentions data or data analysis, but provides no specifics. | Plan mentions data or data analysis, but provides no specifics. | Information presented is vague or confusing. |
| **3** | Plan will likely yield data unrelated to research question, requires major modifications. | Data system described but requires major modification. NASA-provided data system incorrectly utilized and requires major adjustments. | A good start, but many key questions are not addressed. Information is not clearly described; there appear to be serious problems. |
| 4 | Plan will likely yield relevant data, provides plans for appropriate analysis, but has implementation issues (e.g., requires spectrometry). | Data system described but requires minor modification. NASA-provided data system utilization requires minor adjustments. | Information is reasonably clear, but some key areas are not addressed. |
| 5 | Plan will likely yield relevant data, plans for appropriate analysis are practicable, and requires little, if any, modification. | Data system described appears satisfactory. NASA-provided data system utilized properly. | Clear and thorough, most key areas are addressed. The information is clear and complete or requires only minor changes to meet requirements. |

# III. TEAM ORGANIZATION

| | A. Team Preparedness | B. Evidence of relevant skills and experiences | C. Team Support |
|---|---|---|---|
| **POINTS** | **The proposal indicates specifically how the team is prepared to carry out the experiment and the writing of the final report.** | **The proposal states clearly the contributions and skills for each team member and how all the members of the team will share an appropriate distribution of workload and responsibilities.** | **Has the team effectively enlisted the support and cooperation of the school and community?** |
| **1** | No information is provided. | No information is provided. | No information is provided. |
| **2** | The team appears well-composed, but the work appears to be too complex for them. | Description of reasonable division of labor is provided. | The team presents a plan to enlist the support they require. |
| **3** | Description of reasonable division of labor and plans (i.e., task lists, schedules) are provided about how the team would work together. | Members of the team have worked together successfully in the past (e.g., they had a successful science fair project, team project, other competitions, etc.) and have provided a description of a reasonable division of labor. | Qualified individuals have already contributed. |

# IV. CREATIVITY, ORIGINALITY, ATTENTION TO DETAIL

| POINTS | 1. The proposal shows a creative way to study an idea. | 2. The team has demonstrated originality in the proposal. | 3. The proposal shows attention to detail through correct spelling/ grammar/ format. | 4. The figures are identified, numbered, and referenced in the text. |
|---|---|---|---|---|
| 1 | No creativity applied. Simple use of standard lab experiment. | Plagiarism evident. Major adult input to proposal evident. | Spelling errors, grammatical errors, and/or format problems are very evident. | No figure reference methodology used. |
| 2 | Adaptation of standard lab experiment. | Uncredited reference material included in proposal. | Some such errors exist, but are not prevalent. | Inconsistent or incomplete figure reference methodology. |
| 3 | Creative experiment idea for microgravity investigation. | The proposal appears to be the work of student team members. | No problems in this area. | No problems in this area. |

# V. RESOURCE CREDITS

| POINTS | There are many (5 or more) relevant citations from multiple sources (i.e., not exclusively from the Internet) that are directly related to the proposal. |
|---|---|
| 1 | No reference citations included. |
| 2 | Reference citations were all of one type (with no justifiable reason). References are not related to proposal topic. |
| 3 | (graduated scoring) |
| 4 | Reference citations were slightly mixed type. Some references not related to proposal topic. |
| 5 | (graduated scoring) |
| 6 | Reference citations meet stated requirements. References are related to proposal topic. |
| 7 | (graduated scoring) |
| 8 | Reference citations fully meet stated requirements. Excellent mix of appropriate reference sources. |

## Acknowledgements

The Dropping In a Microgravity Environment (DIME) program is a cooperative effort of many organizations.

- Microgravity Science Division at NASA Glenn Research Center, Cleveland, Ohio
- National Center for Microgravity Research on Fluids and Combustion at NASA Glenn Research Center, Cleveland, Ohio
- Office of Educational Programs at NASA Glenn Research Center, Cleveland, Ohio
- Office of Biological and Physical Research at NASA Headquarters, Washington DC
- Office of Education at NASA Headquarters, Washington DC

The DIME program is carried out by personnel in the NASA Glenn Research Center Microgravity Science Division and the National Center for Microgravity Research on Fluids and Combustion.

Critical support also comes from the staff of the 2.2 Second Drop Tower facility and the Imaging Technology Center.

Documents and other information related to the DIME program may be accessed at the following World Wide Web address:

`http://microgravity.grc.nasa.gov/DIME.html`


**NOTE:**

Use of commercial names and products does not imply an endorsement by NASA.



**May 27, 2004**